

PRELIMINARY DATA SUMMARY

June 1986

U.S. Army Engineer Waterways Experiment Station  
Coastal Engineering Research Center  
Field Research Facility  
Duck, North Carolina

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CERC Field Research Facility  
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Field Research Facility Measurement and Analysis Work Unit at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility in Duck, North Carolina. The data were collected and the analyses performed by the FRF staff. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

## CONTENTS

	Page
COVER	
TITLE PAGE	
TABLE OF CONTENTS . . . . .	1
I INTRODUCTION . . . . .	2
II METEOROLOGICAL DATA . . . . .	6
III WAVE DATA . . . . .	9
IV CURRENT DATA . . . . .	14
V SUPPLEMENTAL OBSERVATIONS . . . . .	20
VI WATER LEVELS . . . . .	22
VII NEARSHORE PROFILES AND BATHYMETRY . . . . .	25
VIII SPECIAL EVENTS . . . . .	28
 FIGURES  	
1 LOCATION MAP . . . . .	3
2 INSTRUMENT LOCATIONS . . . . .	5
3 TIME HISTORY OF WAVE HEIGHTS AND PERIODS . . . . .	12
4 WATER LEVEL TIME HISTORY . . . . .	23
5 CRAB PROFILES . . . . .	25
6 CRAB PROFILE ENVELOPE . . . . .	26
7 FRF CONTOUR DIAGRAM . . . . .	27
 TABLES  	
1 INSTRUMENT STATUS/DATA AVAILABILITY . . . . .	4
2 METEOROLOGICAL DATA . . . . .	7
3 WAVE DATA . . . . .	10
4 CURRENT DATA . . . . .	15
5 SUPPLEMENTAL OBSERVATIONS . . . . .	21
6 TIDAL CHARACTERISTICS . . . . .	24

## I. INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Fig.1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The FRF consists of a 561-m (1,840 ft) long concrete research pier supported on 0.91 m (3 ft) diameter steel piles. The pier deck is 6.1 m (20 ft) wide, 7.74 m (25.4 ft) above mean sea level (MSL), and extends from behind the dunes to approximately the 7.6 m (25 ft) depth contour. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Most of the data are daily observations or the results of preliminary data analysis. In many instances, continuous analog records and more extensive analyses will be made available later by the CERC Coastal Engineering Information and Analysis Center (CEIAC).

Table 1 is a list of instruments used, their status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depth at the wave gages and current meters vary and may best be determined from the information contained in Figure 8. Other installation information is contained in Table 1. All times unless otherwise specified are referenced to Eastern Standard Time (EST).

Section II presents the meteorological data; Sections III through VI, oceanographic data; Section VII, nearshore profiles and bathymetry; and Section VIII, if included, documents special events that occurred at the FRF during the month.

Questions and/or comments concerning the data may be directed to Mr. Herman C. Miller at (919) 261-3511.

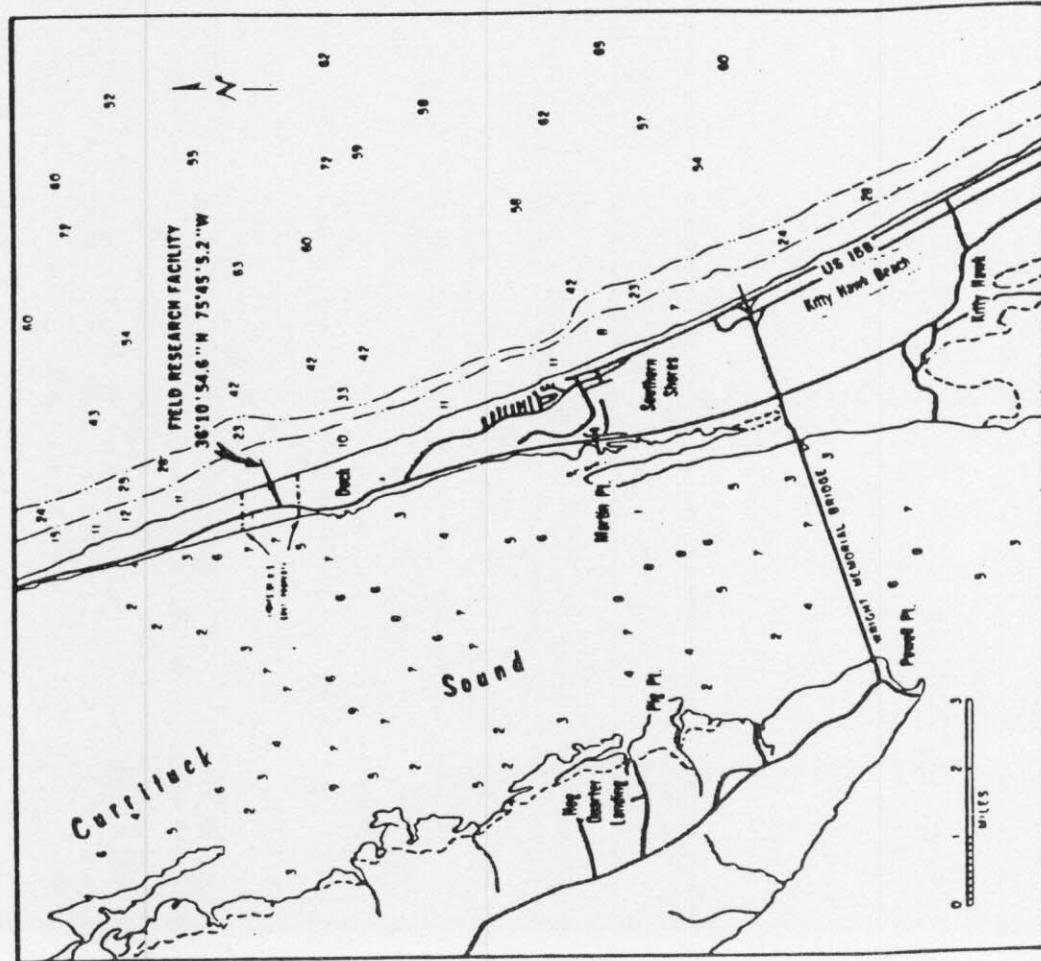
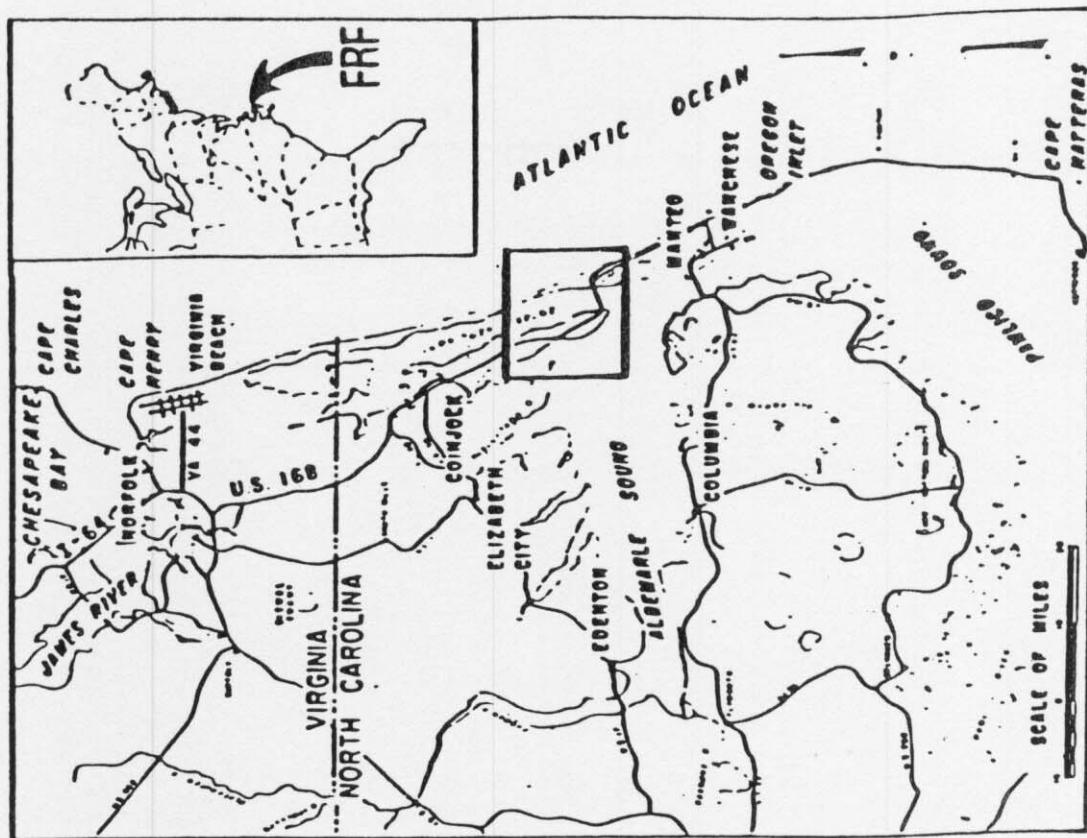


Figure 1. FRF Location Map

TABLE 1  
Instrument Status/Data Availability

June 1986

CAGE NUMBER		DESCRIPTION/REMARKS	DEPTH AT SENSOR	DAY OF THE MONTH
				1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30
			Instrument Status	
		Barometric Pressure	Data Collected	
		Analog Record	Instrument Status	
		Data Collected	Data Collected	
		Analog Record	Instrument Status	
		Data Collected	Data Collected	
		Maximum Minium	Instrument Status	
		Data Collected	Data Collected	
		Analog Record	Instrument Status	
		Data Collected	Data Collected	
		See profile	Instrument Status	
		data	Data Collected	
		See profile	Instrument Status	
		data	Data Collected	
		See profile	Instrument Status	
		data	Data Collected	
		Approx. 8.5 m.	Instrument Status	
		Data Collected	Data Collected	
		MSL	Instrument Status	
		18 m.	Data Collected	
		MSL	Instrument Status	
		18 m.	Data Collected	
		MSL	Instrument Status	
		See profile	Data Collected	
		data	Instrument Status	
		Approx. 6 m	Data Collected	
		MSL	Instrument Status	
		NOAA primary tide station located at seaward end of pier	Data Collected	
			Instrument Status	
			Data Collected	

Instrument Status: Operational - Daily Observation: YES Data Collected: ALL

Analog Record: ALL █ , PARTIAL █  
Preliminary Analysis: ALL █ , SOME █

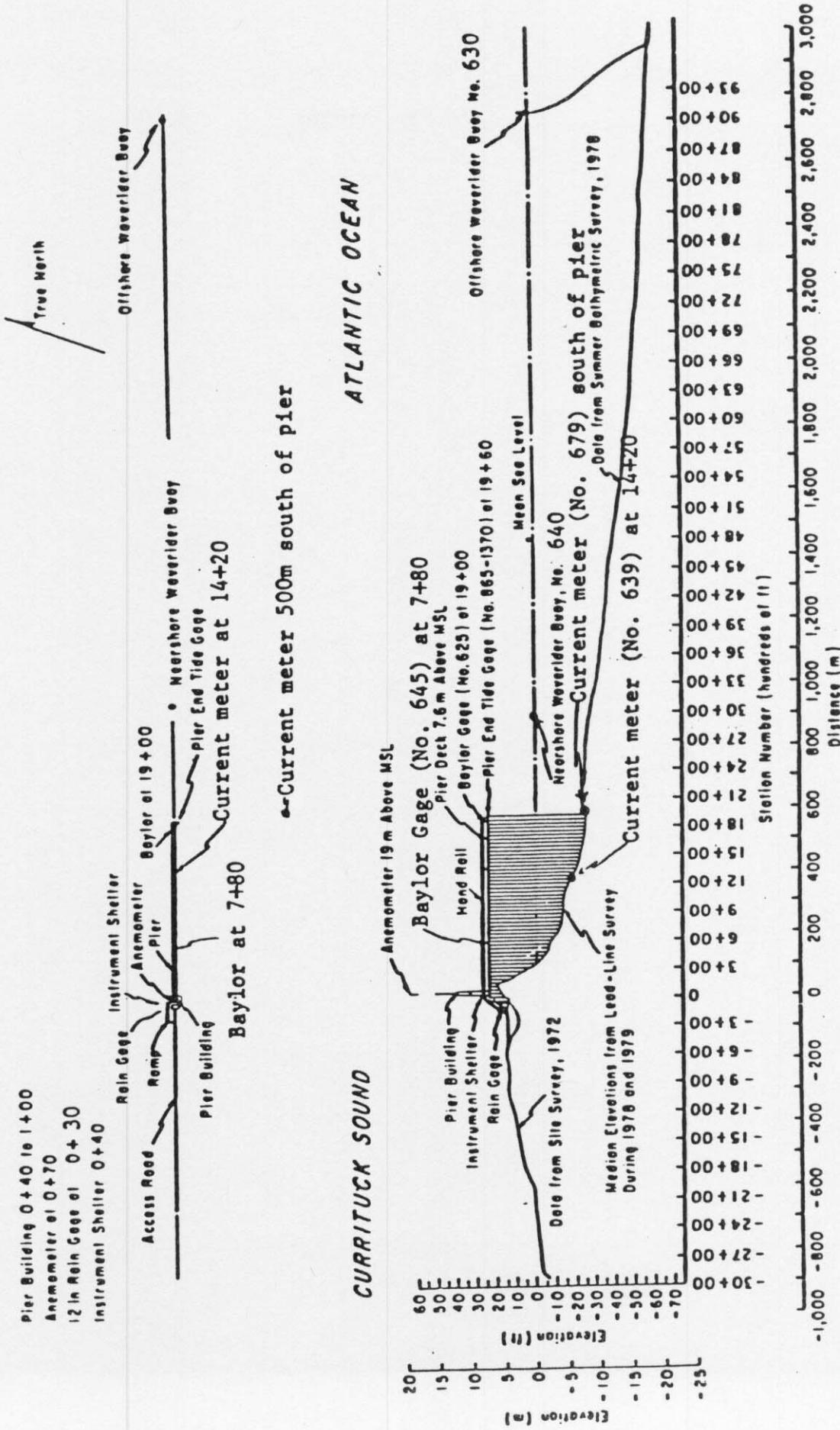


Figure 2. Instrument locations at FRF.

## II. METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Fig. 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored on magnetic tape using a Data General NOVA-4 computer. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

The wind measurements are obtained from a Weather Measure Skyvane located on the FRF laboratory building (Fig. 2), 19.1 m above mean sea level (MSL).

The high and low temperatures are obtained from daily readings of NWS maximum and minimum thermometers and represent the extreme temperature values since the last reading.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in) -  
 $mm \times .03937 = in$
2. Millibars (mb) to inches of mercury (in Hg) -  
 $mb \times 0.02953 = in Hg$
3. Degrees Celcius (C) to degrees Fahrenheit (F) -  
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -  
 $m/s \times 1.943 = kn$

TABLE 2: METEOROLOGICAL DATA

PART 1

JUNE 1986

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
1	100	3	187	23.7	1010.4	0
	700	3	252	25.0	1010.5	0
	1300	6	144	28.6	1010.3	0
	1900	6	197	27.4	1008.8	0
2	100	8	228	25.5	1009.7	0
	700	6	215	24.1	1010.0	0
	1300	6	243	31.9	1011.4	0
	1900	12	34	20.2	1014.1	0
3	100	13	55	18.3	1018.2	0
	700	11	56	18.2	1022.5	0
	1300	9	51	18.8	1025.0	0
	1900	9	62	18.1	1024.0	0
4	100	7	124	19.6	1023.6	0
	700	7	112	20.7	1023.5	0
	1300	3	298	24.8	1023.2	0
	1900	3	280	21.6	1021.3	0
5	100	3	244	21.0	1020.5	0
	700	1	147		1019.5	0
	1300	4	270	26.1	1018.8	0
	1900	4	290	22.3	1017.8	0
6	100	3	223	22.3	1016.9	0
	700	3	252	22.5	1016.4	3
	1300	7	230	23.1	1015.1	0
	1900	5	249	22.2	1013.1	0
7	100	4	188	23.4	1012.1	0
	700	3	245	21.8	1011.5	3
	1300	4	290	25.9	1009.9	0
	1900	3	327	23.0	1008.4	0
8	100	3	93	23.6	1008.7	0
	700	6	119	25.4	1009.2	0
	1300	4	140	31.5	1009.1	0
	1900	5	142	26.0	1009.1	0
9	100	5	122	24.7	1011.4	0
	700	7	22	24.3	1014.6	0
	1300	8	342	23.4	1018.4	0
	1900	6	320	21.3	1018.6	0
10	100	4	294	21.0	1020.3	0
	700	5	312	22.5	1022.0	0
	1300	4	316	24.9	1022.9	0
	1900	6	271	22.2	1020.8	0
11	100	5	170	22.6	1019.4	0
	700	6	155	22.9	1017.9	0
	1300	6	149	29.4	1015.0	0
	1900	7	169	27.7	1012.3	0
12	100	8	155	25.6	1012.4	0
	700	6	153	26.8	1012.1	0
	1300	4	166	33.9	1011.4	0
	1900	8	168	29.9	1009.6	0
13	100	5	156	26.8	1011.7	0
	700	5	106	26.9	1012.8	0
	1300	5	359	23.6	1015.6	0
	1900	3	301	23.3	1016.1	0
14	100	5	305	22.2	1018.2	0
	700	7	314	22.6	1019.1	0
	1300	6	328	24.2	1020.1	0
	1900	6	292	23.2	1018.9	0
15	100	3	271	23.2	1019.3	0
	700	2	192	25.5	1020.1	0
	1300	3	230	23.8	1019.4	19
	1900	7	150	22.8	1019.9	0
16	100	4	216	23.8	1019.8	0
	700	7	170	23.4	1019.8	0
	1300	6	173	26.1	1018.9	0
	1900	7	178	25.8	1015.0	0

TABLE 2: METEOROLOGICAL DATA

PART 2

JUNE 1986

DAY	HOUR	WIND SPEED (M/S)	WIND DIRECTION (DEG TN)	TEMPERATURE (DEG C)	ATM PRESSURE (MB)	PRECIPITATION (MM)
17	100	8	143	24.3	1015.3	0
	700	8	129	24.7	1014.3	0
	1300	3	327	23.8	1014.9	0
	1900	6	322	20.7	1015.3	0
18	100	8	320	21.3	1016.4	0
	700	6	353	22.1	1017.6	0
	1300	5	345	22.9	1019.2	0
	1900	5	272	20.7	1018.2	0
19	100	2	211	18.3	1019.4	0
	700	3	232	23.6	1020.8	0
	1300	6	244	27.3	1020.7	0
	1900	6	182	24.9	1018.7	0
20	100	7	158	23.4	1017.9	0
	700	9	148	23.8	1017.1	0
	1300	5	114	28.5	1014.9	0
	1900	4	185	19.4	1016.3	29
21	100	4	278	18.4	1016.4	0
	700	10	333	20.5	1019.4	0
	1300	6	353	21.5	1021.4	0
	1900	7	320	20.5	1021.1	0
22	100	3	321	19.6	1021.4	0
	700	4	60	20.8	1021.4	0
	1300	5	261	23.4	1020.7	0
	1900	4	207	22.7	1017.7	0
23	100	9	149	23.0	1017.1	0
	700	10	138	23.5	1016.4	0
	1300	5	152	28.8	1014.8	0
	1900	2	175	25.3	1014.2	0
24	100	8	156	24.9	1014.6	0
	700	9	152	25.3	1014.0	0
	1300	7	132	30.1	1013.3	0
	1900	8	170	23.8	1012.9	11
25	100	7	131	23.4	1014.2	0
	700	6	348	20.6	1017.3	0
	1300	5	339	22.8	1019.9	0
	1900	2	319	20.9	1020.0	0
26	100	4	270	20.4	1021.9	0
	700	4	279	22.0	1023.9	0
	1300	4	254	25.0	1024.6	0
	1900	5	212	24.0	1022.8	0
27	100	5	168	23.0	1023.6	0
	700	6	163	24.3	1023.1	0
	1300	8	167	30.2	1020.4	0
	1900	6	184	26.3	1014.8	0
28	100	8	153	25.6	1014.3	0
	700	8	142	26.1	1012.6	0
	1300	4	140	31.2	1010.4	0
	1900	5	179	23.9	1013.9	24
29	100	4	166	24.2	1013.9	0
	700	5	129	24.4	1013.2	0
	1300	6	253	28.6	1011.7	0
	1900	8	294	24.2	1010.8	0
30	100	8	239	25.1	1011.1	0
	700	5	270	25.5	1012.0	0
	1300	3	27	25.9	1013.7	0
	1900	6	98	23.8	1013.9	0

### III. WAVE DATA

Wave data were collected from two Baylor staff gages (CERC gage Nos. 625 and 645) and Waverider buoys (CERC gage Nos. 630 and 640, Table 1 and Figure 2). The data were collected, analyzed, and stored on magnetic tape using a Data General NOVA-4 computer.

The NOVA-4 is programmed to sample the wave gages every 6 hours near 0100, 0700, 1300, and 1900 EST at a sampling rate of four times per second, collecting data in 20- minute records.

Wave height ( $H_{mo}$ ) is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. The wave period is identified from the computation of a variance (energy) spectrum using a Fast Fourier Transform of 4096 data points (1024 sec). The period ( $T_p$ ) is that associated with the maximum energy density in the spectrum. When this analysis is complete, the data are written to magnetic tape and entered into the CERC data base.

Table 3 presents the wave heights and periods for each wave record obtained during the month. The monthly means shown in Table 3 are an average of the values computed for all data records collected. The monthly standard deviations are standard deviations from the monthly mean of values for each record.

Figure 3 is a time history of the  $H_{mo}$  and  $T_p$  values for the Waveriders, 6 km from shore (630) and 1 km from shore (640).

Differences in wave periods between wave gages (Table 4 and Figure 3) may be due to wave breaking or reformation, or the presence of multiple wave trains containing nearly equal energy.

TABLE 3: WAVE DATA

PART 1

JUNE 1986

GAGE		645		625		640		630	
DAY	TIME	Baylor at 7+80 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearsho Wvrdr Hmo(m)	T(sec)	Farsho Wvrdr Hmo(m)	T(sec)
1	1	.24	5.63	.39	8.83	.34	5.63	.38	7.42
	7	.49	5.02	.36	8.06	.32	8.83	.37	5.31
	13			.31	8.06	.34	8.06	.37	8.06
	19			.39	8.83	.38	3.26	.38	3.15
2	1	*		.38	8.06	.37	8.83	.46	8.83
	7			.35	5.02	.30	5.31	.42	5.02
	13	.37	8.83	.31	8.83	.28	8.83	.39	5.31
	19	1.03	4.32	*		1.24	4.76	1.32	5.02
3	1	1.26	5.63	1.78	6.40	1.78	5.63	1.91	5.99
	7	1.04	6.40	1.85	5.63	1.83	7.42	1.96	7.42
	13	1.03	6.87	1.57	5.99	1.53	8.83	1.59	8.83
	19	.94	4.32	1.33	7.42	1.40	6.87	1.29	5.99
4	1	1.01	6.40	*		1.37	8.83	1.42	5.99
	7	.64	5.02	1.09	7.42	.97	9.75	1.15	6.87
	13	*		.83	7.42	.83	7.42	1.00	5.99
	19	.58	6.40			.83	5.99	.89	5.99
5	1	.79	5.99			.73	6.40	.93	5.99
	7			*		*		*	
	13	*				.74	6.87	.87	6.87
	19					.74	6.87	*	
6	1	.78	5.02	.93	6.87			.88	6.87
	7	.77	5.63			.96	7.42	1.12	6.87
	13	*				.92	7.42	1.08	6.40
	19	.99	8.06	Gage Inoperative		1.28	6.40	1.46	7.42
7	1	1.02	7.42			1.03	8.06	1.28	8.83
	7	.95	5.63			1.06	8.83	1.49	6.87
	13	1.18	6.87			1.12	7.42	1.26	6.40
	19	1.11	8.06			1.25	8.06	1.35	7.42
8	1	.95	8.83			.99	8.83	1.26	7.42
	7	.70	9.75			.94	9.75	1.04	9.75
	13	.71	16.79			.74	8.83	.80	8.83
	19	.67	14.22			.82	14.22	.82	8.06
9	1	.46	14.22			*		.79	8.06
	7		*			.73	14.22	.75	14.22
	13		*			.95	4.53	1.43	4.76
	19					1.01	5.02	1.36	5.31
10	1	.67	* 14.22			.82	6.87	.95	7.42
	7		*			.90	6.87	.97	14.22
	13	.55	14.22			.79	14.22	.84	14.22
	19	.58	14.22			.81	14.22	.76	14.22
11	1	.40	14.22			.70	14.22	.73	6.87
	7	.32	14.22			.57	14.22	.68	14.22
	13	.35	14.22			.52	14.22	.70	7.42
	19	.38	7.42			.50	8.83	.72	8.06
12	1	.33	8.06			.40	12.34	.54	12.34
	7	.38	12.34			.40	14.22	.52	14.22
	13	.45	8.83			.46	8.83	.51	7.42
	19	.52	8.83			.48	8.83	.65	3.79
13	1	*				.46	12.34	.58	8.83
	7	.25	12.34			.47	12.34	.57	12.34
	13	.62	5.99			.58	6.40	.71	6.87
	19	.52	7.42			.71	8.83	.83	8.06
14	1	.46	5.02			.67	8.06	.79	7.42
	7	.74	3.15			.79	8.06	.88	7.42
	13	.61	3.64			.78	8.06	.82	8.83
	19	*				.76	8.06	.78	8.06
15	1	.41	8.06			.64	8.83	.69	8.06
	7	.45	7.42			.57	8.83	.67	8.83
	13	.30	8.06			.49	8.06	.58	8.06
	19	.47	8.83			.44	8.06	.60	8.06
16	1	*				.41	8.83	.49	7.42
	7	.34	8.06			.42	8.06	.59	7.42
	13	.21	14.22			.35	12.34	.43	10.89
	19	.46	12.34			.44	12.34	.54	10.89

\*=Electronic Problems

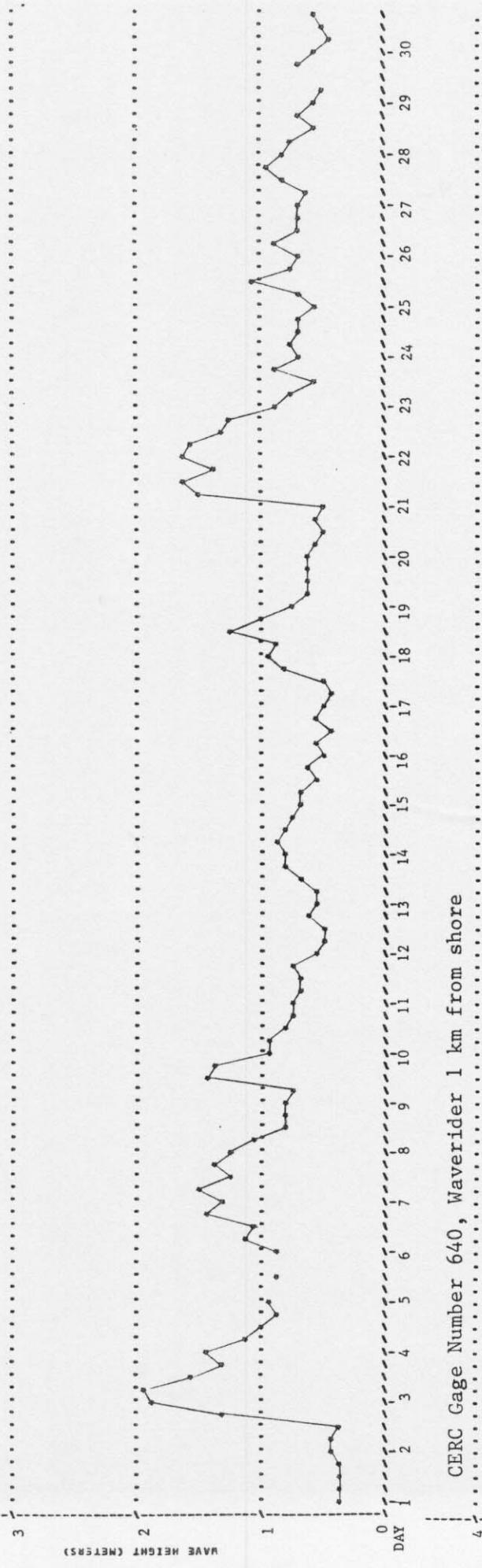
TABLE 3: WAVE DATA

PART 2

JUNE 1986

GAGE		645		625		640		630	
DAY	TIME	Baylor at 7+00 Hmo(m)	T(sec)	Baylor at 19+00 Hmo(m)	T(sec)	Nearshtr Hmo(m)	Wvrdr T(sec)	Farshtr Hmo(m)	Wvrdr T(sec)
17	1	.35	4.32			.41	10.89	.53	7.42
	7	.37	5.63			.32	12.34	.46	4.76
	13	.34	6.40			.43	5.31	.50	8.06
	19	.66	4.13			.80	4.13	.82	3.95
18	1	.75	4.76			.88	6.40	.93	5.02
	7	.66	4.76			.79	4.13	.89	3.79
	13	.96	5.31			1.11	5.63	1.24	5.02
	19	.70	5.63			.76	6.40	1.01	5.99
19	1	.48	5.99			.61	6.40	.77	5.99
	7	*				.54	8.83	.65	5.31
	13	.44	14.22			*		.65	14.22
	19	*				.54	14.22	.63	14.22
20	1	.43	14.22			.46	14.22	.63	8.83
	7	.36	14.22			.43	14.22	.58	8.83
	13	.43	14.22			.44	14.22	.53	14.22
	19	*				.53	14.22	.54	14.22
21	1	.35	14.22			.45	14.22	.49	14.22
	7	1.04	5.31			1.48	5.31	1.52	5.31
	13	1.04	6.40			1.50	6.40	1.62	7.42
	19	.61	5.63			1.32	6.40	1.40	7.42
22	1	.92	10.89			1.50	7.42	1.64	6.87
	7	.66	8.83			1.34	10.89	1.57	10.89
	13	.87	8.83			1.22	10.89	1.31	10.89
	19	.63	10.89			1.13	10.89	1.26	9.75
22	-	.43	10.89			.75	8.83	.89	8.83
	7	*				.60	9.75	.75	9.75
	13	.30	10.89			.53	9.75	.54	8.83
	19	.39	10.89			.65	9.75	.88	9.75
24	1	*				.47	9.75	.70	9.75
	7	*				.49	9.75	.77	8.83
	13					.55	9.75	.69	8.83
	19	.38	9.75			.52	9.75	.72	8.83
25	1	*				.49	9.75	.59	9.75
	7	.37	8.83			.51	8.83	.70	8.83
	13	*				.97	5.31	1.08	5.02
	19	.52	5.02			.68	8.83	.77	8.83
26	1	.52	4.76			.57	8.83	.67	9.75
	7	.71	5.63			.77	5.02	.86	5.31
	13	.46	8.83			.61	9.75	.68	8.06
	19	.48	8.06			.64	6.87	.71	8.06
27	1	.39	8.83			.58	8.83	.66	8.06
	7	*				.54	9.75	.63	8.83
	13					.63	8.83	.79	8.83
	19	.79	5.31			.69	9.75	.93	8.83
28	1	.52	5.63			.65	9.75	.82	8.83
	7	.45	5.02			.55	9.75	.72	8.83
	13	.33	8.83			.51	8.83	.59	8.83
	19	.58	8.83			.55	8.83	.66	8.83
29	1	.34	8.83			.44	8.06	.53	9.75
	7	.47	9.75			.49	8.83	.53	*
	13	*				*			
	19	.43	5.31			.52	9.75	.67	9.75
30	1	.26	9.75			.39	8.06	.54	8.83
	7	.30	8.83			.36	9.75	.46	8.83
	13	*				.38	8.83	.50	9.75
	19	*				.56	8.83	.55	8.83
MEAN		.59	8.41	.83	7.98	.72	8.95	.84	8.33
STD		.26	3.35	.54	2.62	.33	2.68	.35	2.57

\*=Electronic Problems



12

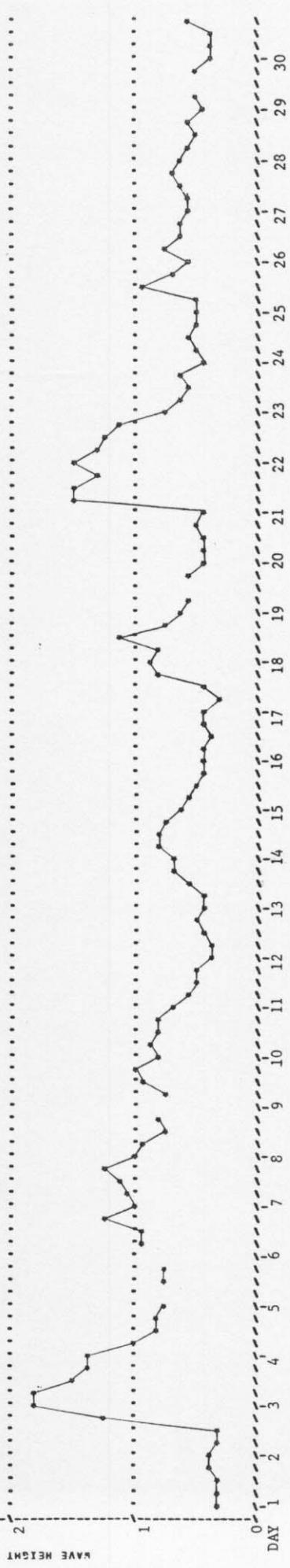
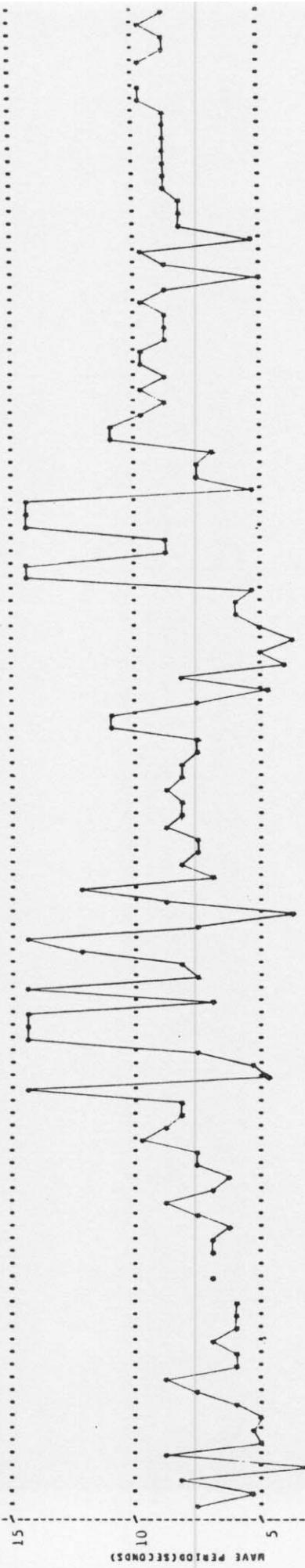


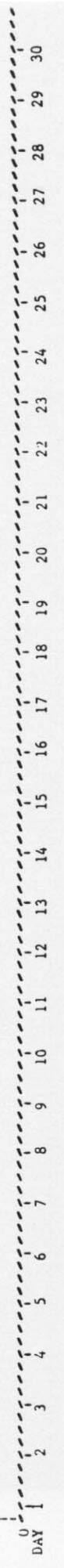
FIGURE 3. Time History of Wave Heights and Periods - June 1986

Part I: Heights

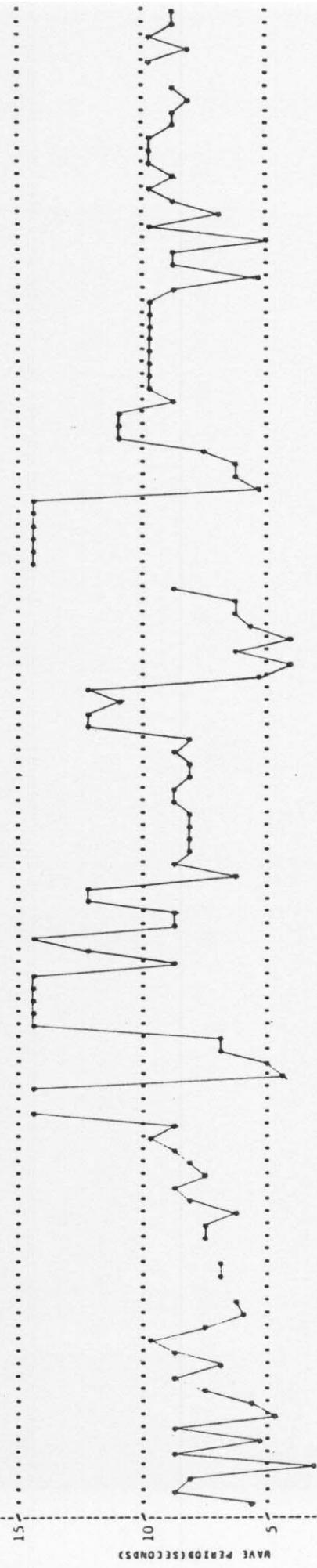


13

GERC Gage Number 640, Waverider 1 km from shore



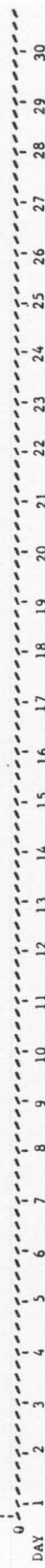
20



WAVE PERIOD (SECONDS)

FIGURE 3. Time History of Wave Heights and Periods - June 1986

Part III: Period



#### IV. CURRENT DATA

Current data (Table 4) are collected from two Marsh-McBirney electromagnetic biaxial current meters (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, alongshore currents flow either toward 340 (i.e. northward) or toward 160 (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second.

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)  
June 1986

DAY:	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500 UPDRIFT)			CURRENT METER AT SOUTH TRIPOD		
		DYE AT	CURRENT METER	DYE AT MID-SURF ZONE	DYE	AT SOUTH TRIPOD				
		19+00 (579m)	AT 14+20(433m)	I.D.#639 (SURFACE) (DEPTH -4.2m MSL)	(SURFACE)	12M OFFSHORE	(DEPTH -4.8m MSL)	I.D.#679		
DAY:	TIME	SPEED	DIR	SPEED	DIR	BASELINE(M)	SPEED	DIR	LOCATION	SPEED
1	0100-Alongshore	10	N							6
	Cross-shore	6	OF							6
	Resultant	12	19							10
1	0700-Alongshore	11	N	1	N	4	N		12	N
	Cross-shore	7	Off	1	OF	128	3	Off		3
	Resultant	13	11	1	21	5	11			4
1	1300-Alongshore	2	N							1
	Cross-shore	2	OF							4
	Resultant	3	28							4
1	1900-Alongshore	2	N							5
	Cross-shore	2	OF							5
	Resultant	3	22							140
2	0100-Alongshore	2	N							3
	Cross-shore	2	OF							3
	Resultant	3	32							4
2	0700-Alongshore	5	N	1	N	10	N		10	N
	Cross-shore	12	Off	2	OF	128	5	Off		38
	Resultant	13	46	2	44	11	9			72
2	1300-Alongshore	4	N							2
	Cross-shore	1	OF							2
	Resultant	4	14							36
2	1900-Alongshore	11	S							16
	Cross-shore	1	OF							57
	Resultant	11	152							62
3	0100-Alongshore	27	S							29
	Cross-shore	2	ON							8
	Resultant	27	165							30
3	0700-Alongshore	41	S	24	S	61	S		48	S
	Cross-shore	8	On	6	ON	188	15	On		40
	Resultant	41	171	25	174	63	174			B
3	1300-Alongshore	20	S							41
	Cross-shore	4	ON							148
	Resultant	20	170							24
3	1900-Alongshore	13	S							29
	Cross-shore	2	OF							8
	Resultant	13	152							30
4	0100-Alongshore	5	N							144
	Cross-shore	18	OF							3
	Resultant	18	54							OF
4	0700-Alongshore	14	N	3	N	55	N		20	N
	Cross-shore	6	On	4	OF	140	14	Off		0
	Resultant	15	318	5	33	57	354			?
4	1300-Alongshore	5	N							20
	Cross-shore	4	OF							1
	Resultant	6	23							43
4	1900-Alongshore	9	N							9
	Cross-shore	7	OF							5
	Resultant	12	19							2
5	0100-Alongshore	15	N							10
	Cross-shore	12	OF							1
	Resultant	19	20							32
5	0700-Alongshore	19	N	15	N	20	N		40	N
	Cross-shore	2	On	12	ON	128	6	Off		8
	Resultant	19	334	20	301	21	357			22
5	1300-Alongshore	7	N							5
	Cross-shore	6	OF							3
	Resultant	9	20							8
5	1900-Alongshore	8	N							10
	Cross-shore	9	OF							3
	Resultant	12	28							358
6	0100-Alongshore	10	N							11
	Cross-shore	7	OF							4
	Resultant	12	16							0
6	0700-Alongshore	38	N	11	N	51	N		99	N
	Cross-shore	0	0	15	OF	128	7	Off		6
	Resultant	38	340	19	34	51	349			1
6	1300-Alongshore	7	N							13
	Cross-shore	8	OF							2
	Resultant	10	28							347
6	1900-Alongshore	9	N							17
	Cross-shore	9	OF							4
	Resultant	13	25							355

KEY = ALL SPEEDS IN CM/SEC  
N =NORTHWARD, SHORE PARALLEL  
S =SOUTHWARD, SHORE PARALLEL  
ON=ONSHERE  
OF=OFFSHORE

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)

DAY:	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500' UPDRIFT)			CURRENT METER		
		DYE AT	CURRENT METER		DYE AT MID-SURF ZONE	(SURFACE)	DIST. FROM	12M OFFSHORE	(DEPTH -4.2m MSL)	AT SOUTH TRIFID
7	0100-Alongshore	19+00	A1	14120(433m)	(579m)	I.D.#639	(SURFACE)			
	Cross-shore									
	Resultant									
7	0700-Alongshore	44	N	5	N		34	N		
	Cross-shore	2	On	3	OF		176	20	Off	
	Resultant	44	337	6	15		39	11		
7	1300-Alongshore									
	Cross-shore									
	Resultant									
7	1900-Alongshore									
	Cross-shore									
	Resultant									
8	0100-Alongshore									
	Cross-shore									
	Resultant									
8	0700-Alongshore	61	S	5	S		76	N		
	Cross-shore	0	0	4	OF		128	4	Off	
	Resultant	61	160	6	123		76	343		
8	1300-Alongshore									
	Cross-shore									
	Resultant									
8	1900-Alongshore									
	Cross-shore									
	Resultant									
9	0100-Alongshore									
	Cross-shore									
	Resultant									
9	0700-Alongshore	30	S	16	S		28	S		
	Cross-shore	5	On	7	OF		128	4	On	
	Resultant	31	169	18	135		28	169		
9	1300-Alongshore									
	Cross-shore									
	Resultant									
9	1900-Alongshore									
	Cross-shore									
	Resultant									
10	0100-Alongshore									
	Cross-shore									
	Resultant									
10	0700-Alongshore	25	S	14	S		51	N		
	Cross-shore	5	On	5	OF		128	3	Off	
	Resultant	26	171	15	139		51	343		
10	1300-Alongshore									
	Cross-shore									
	Resultant									
10	1900-Alongshore									
	Cross-shore									
	Resultant									
11	0100-Alongshore									
	Cross-shore									
	Resultant									
11	0700-Alongshore	27	N	4	S		47	N		
	Cross-shore	8	Off	15	OF		128	12	Off	
	Resultant	28	357	15	85		48	354		
11	1300-Alongshore									
	Cross-shore									
	Resultant									
11	1900-Alongshore									
	Cross-shore									
	Resultant									
12	0100-Alongshore									
	Cross-shore									
	Resultant									
12	0700-Alongshore	22	N	1	N		68	N		
	Cross-shore	13	Off	4	OF		128	3	Off	
	Resultant	25	111	4	59		68	343		
12	1300-Alongshore									
	Cross-shore									
	Resultant									
12	1900-Alongshore									
	Cross-shore									
	Resultant									

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S = SOUTHWARD, SHORE PARALLEL  
ON=ONSHORE  
OF=OFFSHORE

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)

DAY:	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500' UPDRIFT)			CURRENT METER		
		DYE AT	CURRENT METER	DYE AT MID-CURF ZONE	DYE	AT SOUTH TRIPOD	(DEPTH -4.8m MSL)			
		19+00 (579m)	AT 14+20(433m) I.D.#639	(SURFACE)	12M OFFSHORE DIST. FROM (SURFACE)	I.D.#679				
		(SURFACE)	(DEPTH -4.2m MSL)							
13	0100-Alongshore		0							
	Cross-shore		3	OF					2	OF
	Resultant		3	70					3	115
13	0700-Alongshore	13 S	2	S	51 N		25 N	5	S	
	Cross-shore	6 Off	1	OF	128 0 0		South	3	OF	
	Resultant	14 133	2	137	51 340			6	130	
13	1300-Alongshore		19	S				16	S	
	Cross-shore		7	OF				15	OF	
	Resultant		20	140				22	117	
13	1900-Alongshore		5	S				3	S	
	Cross-shore		12	OF				10	OF	
	Resultant		13	94				10	87	
14	0100-Alongshore		9	S				5	S	
	Cross-shore		5	OF				5	OF	
	Resultant		10	133				8	115	
14	0700-Alongshore	28 S	7	S	38 S		3 N	9	S	
	Cross-shore	14 On	4	OF	154 0 0		North	7	OF	
	Resultant	31 187	8	131	38 160			11	121	
14	1300-Alongshore		9	S				5	S	
	Cross-shore		3	OF				1	ON	
	Resultant		10	143				5	176	
14	1900-Alongshore		11	S				6	S	
	Cross-shore		9	OF				4	OF	
	Resultant		15	120				7	124	
15	0100-Alongshore		3	S				0		
	Cross-shore		4	OF				4	OF	
	Resultant		5	111				4	70	
15	0700-Alongshore	12 N	0		76 N		11 N	5	S	
	Cross-shore	7 Off	5	OF	128 0 0		North	2	OF	
	Resultant	14 11	5	70	76 340			5	135	
15	1300-Alongshore		2	S				7	S	
	Cross-shore		6	OF				3	OF	
	Resultant		7	92				8	134	
15	1900-Alongshore		0					4		
	Cross-shore		4	OF				1	OF	
	Resultant		4	70				4	141	
16	0100-Alongshore		2	N				1	S	
	Cross-shore		5	OF				5	OF	
	Resultant		6	51				5	86	
16	0700-Alongshore	18 N	2	S				3	S	
	Cross-shore	6 Off	5	OF	128 87 N		South	4	OF	
	Resultant	19 359	5	89	88 349			5	106	
16	1300-Alongshore		0					1	N	
	Cross-shore		4	OF				2	OF	
	Resultant		4	70				3	44	
16	1900-Alongshore		1	N				1	N	
	Cross-shore		4	OF				1	OF	
	Resultant		4	58				2	24	
17	0100-Alongshore		0					5	N	
	Cross-shore		4	OF				0		
	Resultant		4	70				5	340	
17	0700-Alongshore	6 N	1	N				1	N	
	Cross-shore	11 Off	4	OF	128 47 N		South	1	OF	
	Resultant	13 43	5	56	12 326			2	40	
17	1300-Alongshore		1	N				1	N	
	Cross-shore		4	OF				3	DF	
	Resultant		4	61				3	58	
17	1900-Alongshore		8	S				11	S	
	Cross-shore		5	OF				5	OF	
	Resultant		10	127				12	133	
18	0100-Alongshore		10	S				8	N	
	Cross-shore		45	OF				8	OI	
	Resultant		47	83				11	25	
18	0700-Alongshore	6 S	5	S				0		
	Cross-shore	3 Off	9	OF	152 44 S			5	OF	
	Resultant	6 136	10	102	0 0			5	70	
18	1300-Alongshore		12	S				10	S	
	Cross-shore		11	OF				5	OF	
	Resultant		16	117				11	131	
18	1900-Alongshore		17	S				27	S	
	Cross-shore		7	OF				5	OF	
	Resultant		18	138				27	142	

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 OF=OFFSHORE

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)

DAY:	TIME	PIER MEASUREMENTS				BEACH MEASUREMENTS (500' UPKIFT)				CURRENT METER			
		DYE AT 19+00 (579m) (SURFACE)	CURRENT METER AT 14+20(433m) (DEPTH -4.2m MSL)	DYE AT MID-SURF ZONE (SURFACE)	DYE 12M OFFSHORE (SURFACE)	AT SOUTH TRIPOD (DEPTH -4.8m MSL)	I.D.#639	DIST. FROM BASELINE(M)	I.D.#679	SPEED DIR	I.D.	SPEED DIR	I.D.
19	0100-Alongshore	19	S							8	S		
	Cross-shore	17	OF							8	OF		
	Resultant	25	118							11	115		
19	0700-Alongshore	10	S	3	S			38	N	23	N		
	Cross-shore	0	0	11	OF	128	6	On	South	4	OF		
	Resultant	10	160	12	86			39	331	9	131		
19	1300-Alongshore			0						1	N		
	Cross-shore			9	OF					3	OF		
	Resultant			9	20					3	48		
19	1900-Alongshore			0						1	S		
	Cross-shore			6	OF					2	OF		
	Resultant			6	20					2	91		
20	0100-Alongshore			1	N					2	N		
	Cross-shore			6	OF					1	OF		
	Resultant			6	61					3	12		
20	0700-Alongshore	8	N	1	S			20	N	46	N		
	Cross-shore	15	Off	6	OF	140	2	On	South	1	OF		
	Resultant	17	41	7	80			20	334	1	134		
20	1300-Alongshore			1	N					2	N		
	Cross-shore			6	OF					2	OF		
	Resultant			7	59					3	21		
20	1900-Alongshore			3	S					3	S		
	Cross-shore			9	OF					4	OF		
	Resultant			9	90					5	105		
21	0100-Alongshore	2	S							2	S		
	Cross-shore	7	OF							3	OF		
	Resultant	7	84							4	110		
21	0700-Alongshore	21	S	10	S			47	S	32	S		
	Cross-shore	4	On	7	OF	213	26	On	North	6	OF		
	Resultant	21	171	12	127			54	189	13	132		
21	1300-Alongshore			7	S					4	S		
	Cross-shore			7	OF					3	OF		
	Resultant			9	116					5	127		
21	1900-Alongshore			1	S					2	S		
	Cross-shore			9	OF					10	OF		
	Resultant			9	79					10	80		
22	0100-Alongshore	13	S							18	S		
	Cross-shore	16	OF							8	OF		
	Resultant	21	110							19	136		
22	0700-Alongshore	68	S	13	S			22	S	46	S		
	Cross-shore	10	On	4	OF	188	7	Off	North	5	OF		
	Resultant	68	169	13	143			23	143	9	122		
22	1300-Alongshore			9	S					14	S		
	Cross-shore			7	OF					5	OF		
	Resultant			12	120					15	141		
22	1900-Alongshore			3	S					10	S		
	Cross-shore			3	OF					3	OF		
	Resultant			4	114					19	142		
23	0100-Alongshore	2	N							1	S		
	Cross-shore	5	OF							0			
	Resultant	5	47							1	160		
23	0700-Alongshore	11	N	3	N			4	N	7	N		
	Cross-shore	22	Off	6	OF	128	10	Off	South	5	ON		
	Resultant	24	43	6	46			11	48	6	320		
23	1300-Alongshore			4	N					1	N		
	Cross-shore			5	OF					1	OF		
	Resultant			6	34					2	21		
23	1900-Alongshore			4	N					6	N		
	Cross-shore			5	OF					0			
	Resultant			7	33					6	340		
24	0100-Alongshore	3	N							1	N		
	Cross-shore	5	OF							4	OF		
	Resultant	6	34							4	51		
24	0700-Alongshore	20	N	3	N			36	N	15	N		
	Cross-shore	13	Off	4	OF	128	7	Off	South	0	OF		
	Resultant	24	13	5	33			37	351	0			
24	1300-Alongshore			5	N					2	S		
	Cross-shore			4	OF					2	OF		
	Resultant			6	17					2	112		
24	1900-Alongshore			1	S					10	N		
	Cross-shore			3	OF					2	OF		
	Resultant			4	89					11	349		

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 OF=OFFSHORE

TABLE 4: CURRENT DATA  
(SPEEDS IN CM/SEC)

DAY:	TIME	PIER MEASUREMENTS			BEACH MEASUREMENTS (500' UPDRIFT)			CURRENT METER AT SOUTH TRIPOD		
		DYE AT 19+00 (579m) (SURFACE)	CURRENT METER AT 14+20(433m) I.D.#639 (DEPTH -4.2m MSL)	DYE AT MID-SURF ZONE (SURFACE)	DIST. FROM	DYE 12M OFFSHORE (SURFACE)	LOCATION	SPEED 1.1	DIR N	SPEED 1.1
25	0100-Alongshore		2	N						
	Cross-shore		2	OF				5	OF	
	Resultant		3	23				5	54	
25	0700-Alongshore	12 S	6	N				1	S	
	Cross-shore	8 On	1	ON	140	6 N	South	3	OF	
	Resultant	124 195	6	333	2 Off	6 352		3	94	
25	1300-Alongshore		2	N				15	S	
	Cross-shore		2	OF				9	OF	
	Resultant		3	28				17	130	
25	1900-Alongshore		4	N				5	N	
	Cross-shore		2	OF				5	OF	
	Resultant		4	10				8	25	
26	0100-Alongshore		12	S				1	N	
	Cross-shore		16	OF				3	OF	
	Resultant		20	107				3	57	
26	0700-Alongshore	6 N	2	S				2	S	
	Cross-shore	0 0	17	OF	152	34 S	North	4	OF	
	Resultant	6 340	17	78	3 On	34 166		5	B9	
26	1300-Alongshore		14	N				14	S	
	Cross-shore		8	OF				8	OF	
	Resultant		16	9				16	131	
26	1900-Alongshore		19	N				7	S	
	Cross-shore		7	OF				2	OM	
	Resultant		20	1				2	179	
27	0100-Alongshore		18	N				4	S	
	Cross-shore		8	OF				3	OF	
	Resultant		20	4				6	123	
27	0700-Alongshore	23 N	7	N				5	N	
	Cross-shore	9 Off	8	OF	152	41 N	South	1	OF	
	Resultant	24 2	11	28	20 Off	45 7		5	347	
27	1300-Alongshore		7	N				2	S	
	Cross-shore		6	OF				0		
	Resultant		9	21				2	160	
27	1900-Alongshore		14	N				14	N	
	Cross-shore		6	OF				1	OF	
	Resultant		15	2				14	344	
28	0100-Alongshore		8	N				17	S	
	Cross-shore		5	OF				3	ON	
	Resultant		9	13				17	170	
28	0700-Alongshore	15 N	4	N						
	Cross-shore	10 Off	5	OF	140	76 N	South			
	Resultant	18 13	6	32	15 On	45 N				
28	1300-Alongshore		10	N						
	Cross-shore		4	OF						
	Resultant		11	5						
28	1900-Alongshore		1	S						
	Cross-shore		5	OF						
	Resultant		5	27						
29	0100-Alongshore		1	N						
	Cross-shore		4	OF						
	Resultant		4	56						
29	0700-Alongshore	11 N	0	N						
	Cross-shore	17 Off	4	OF	128	76 N	South			
	Resultant	20 36	4	Z0	11 On	41 N				
29	1300-Alongshore		4	N						
	Cross-shore		4	OF						
	Resultant		6	25						
29	1900-Alongshore									
	Cross-shore									
	Resultant									
30	0100-Alongshore									
	Cross-shore									
	Resultant									
30	0700-Alongshore	13 S								
	Cross-shore	5 Off			128	55 N	South			
	Resultant	14 138			3	On				
30	1300-Alongshore									
	Cross-shore									
	Resultant									
30	1900-Alongshore									
	Cross-shore									
	Resultant									
	Inoperative									
	Gage									
	Inoperative									
	Meter Inoperative									

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 OF=OFFSHORE

## V. SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) taken at the seaward end of the pier are made of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves) but not surface chop or capillary waves. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring alignment of the wave crests. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70° east of true north; consequently, wave angles greater than 70° imply the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are made daily at the seaward end of the FRF pier. A jar along with a thermometer is lowered about .3 m (1 ft) into the water and allowed to remain for at least one minute. The jar is removed, the temperature read and a hydrometer is used to determine the density. A secci disc is used to determine the surface visibility.

Table 5  
SUPPLEMENTAL OBSERVATIONS

DAY/TIME	WAVE APPROACH ANGLE AT PIER END (° from True N)		RADAR WAVE ANGLE (° from True N)	WIDTH OF SURF ZONE (M)	WATER CHARACTERISTICS AT PIER END		
	PRIMARY	SECONDARY			TEMP (°C)	DENSITY (g/cc)	SECCI VIS (M)
1 0745	95		120	4	18.7	1.0225	4.3
2 0635	100		135	2	14.2	1.0243	3.6
3 0700	60			179	19.5	1.0227	.6
4 0700	65			37	20.0	1.0201	3.3
5 0700	90			30	20.9	1.0205	3.3
6 0700	90			36	22.5	1.0208	4.3
7 0925	105			130	20.4	1.0232	4.3
8 0900	90			54	20.6	1.0216	3.0
9 0705	5			14	21.7	1.0217	3.0
10 0635	65			26	22.7	1.0200	4.9
11 0650	85		135	15	22.3	1.0210	5.0
12 0655	75		120	8	15.5	1.0240	4.0
13 0710	120			17	16.3	1.0240	4.0
14 0805	Calm			84	22.5	1.0206	5.5
15 0915	75			13	22.8	1.0206	6.0
16 0655	120			21	17.8	1.0235	3.3
17 0655	Calm			10	15.2	1.0241	5.0
18 0655	45			30	19.8	1.0237	4.9
19 0705	70			21	21.2	1.0207	5.0
20 0700	80		120	24	16.1	1.0243	3.3
21 0950	60			179	16.8	1.0244	1.8
22 0955	65			138	21.0	1.0207	3.3
23 0700	70			12	17.3	1.0242	1.5
24 0700	80		130	10	18.0	1.0242	1.8
25 0705	Calm			0	18.6	1.0242	3.6
26 0705	60			35	19.9	1.0241	2.4
27 0705	85		110	22	19.6	1.0234	2.7
28 0910	95			22	18.6	1.0242	2.7
29 0945	130			32	18.9	1.0244	3.3
30 0705	95			14	19.9	1.0244	3.0

## VI. WATER LEVELS

The National Ocean Services (NOS) has established a primary tide station (No. 865- 1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect data every 6 minutes throughout the month.

Figure 4 shows the variation in mean water levels computed over a tidal cycle period (12.42 hours), and contains a list of selected mean and extreme values. This presentation is useful in identifying effects on both meteorological and astronomical forces on the open coast water levels.

Table 6 contains the time of the center of each sampling interval and the range, high, low, and mean water levels during each tidal cycle.

## FRF TIDE HEIGHTS

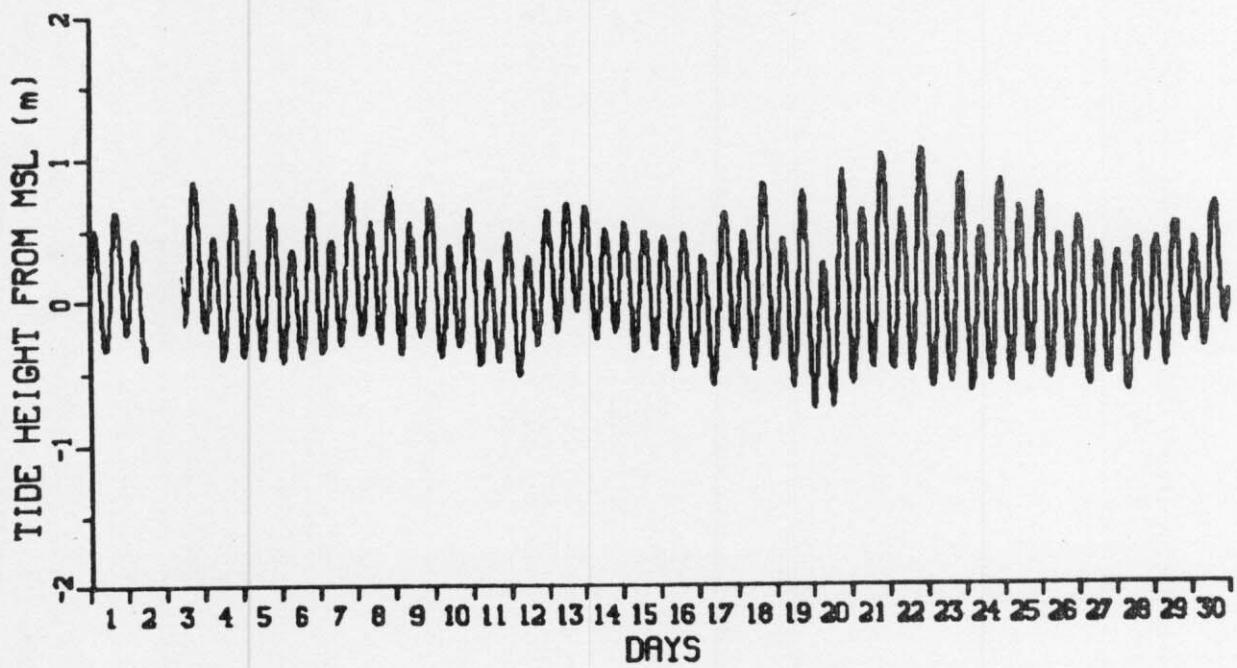


FIGURE 5. Time History of Mean Water Levels, June 1986 (Gage No. 865-1370)

### MONTHLY MEAN WATER LEVELS (METERS MSL)

Extreme Low -	-.76 on 19 June at 2342 hrs.
Extreme High -	1.04 on 22 June at 1918 hrs.
Monthly Mean -	.08
Mean Low Water -	-.43
Mean High Water	.60
Mean Range	1.03

MID-CYCLE DAY	TIME	LOW	HIGH	MEAN	RANGE
1	612	-0.34	0.51	0.09	0.84
1	1837	-0.22	0.63	0.20	0.84
3	2018	-0.20	0.84	0.32	1.04
4	843	-0.40	0.45	0.05	0.85
4	2109	-0.38	0.69	0.14	1.06
5	934	-0.39	0.36	0.01	0.76
5	2159	-0.42	0.66	0.12	1.08
6	1024	-0.39	0.41	0.03	0.80
6	2249	-0.35	0.69	0.15	1.04
7	1115	-0.30	0.54	0.11	0.83
7	2340	-0.22	0.83	0.26	1.05
8	1205	-0.29	0.63	0.17	0.92
9	30	-0.36	0.77	0.19	1.13
9	1255	-0.24	0.60	0.18	0.85
10	121	-0.40	0.72	0.11	1.12
10	1346	-0.31	0.53	0.07	0.84
11	211	-0.45	0.64	0.04	1.09
11	1436	-0.42	0.40	-0.04	0.82
12	301	-0.52	0.47	-0.06	0.99
12	1527	-0.30	0.53	0.06	0.83
13	352	-0.22	0.63	0.21	0.85
13	1617	-0.07	0.68	0.32	0.75
14	442	-0.27	0.65	0.17	0.92
14	1707	-0.22	0.50	0.16	0.72
15	532	-0.35	0.54	0.07	0.89
15	1758	-0.35	0.48	0.09	0.83
16	623	-0.49	0.44	-0.02	0.93
16	1848	-0.46	0.46	-0.01	0.92
17	713	-0.59	0.45	-0.12	1.04
17	1938	-0.32	0.60	0.14	0.93
18	904	-0.49	0.60	0.05	1.09
18	2029	-0.42	0.81	0.16	1.23
19	554	-0.61	0.45	-0.05	1.09
19	2119	-0.76	0.75	-0.05	1.51
20	944	-0.75	0.52	-0.19	1.26
20	2210	-0.59	0.90	0.12	1.48
21	1035	-0.49	0.68	0.13	1.16
21	2300	-0.48	1.01	0.23	1.50
22	1125	-0.50	0.73	0.12	1.23
22	2350	-0.62	1.04	0.17	1.66
23	1216	-0.59	0.57	-0.03	1.16
24	41	-0.64	0.87	0.09	1.51
24	1306	-0.57	0.51	0.01	1.08
25	131	-0.57	0.84	0.12	1.41
25	1356	-0.46	0.64	0.09	1.10
26	222	-0.55	0.74	0.07	1.29
26	1447	-0.49	0.45	0.00	0.94
27	312	-0.61	0.56	-0.03	1.17
27	1527	-0.52	0.38	-0.08	0.90
28	402	-0.64	0.32	-0.16	0.97
29	1628	-0.45	0.41	0.01	0.85
29	453	-0.47	0.42	0.00	0.89
29	1718	-0.30	0.53	0.13	0.84
30	543	-0.34	0.42	0.06	0.77

TABLE 6  
WATER LEVELS (METERS MSL)  
Tidal Characteristics

June 1986

## VII. NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Zeiss surveying system; a Zeiss Elta-2 first-order, self-recording electronic theodolite distance meter in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in May and the three surveys taken during June on profile line 188, located 517 m south of the pier. As a result of the mild weather during June, only minimal changes are visible on the profile line. A small berm (80 to 120 m) was removed from the foreshore in conjunction with the formation of a very small nearshore bar (130 to 160 m). In addition, a 40 m shoreward shift of the offshore bar (280 to 360 m) is visible.

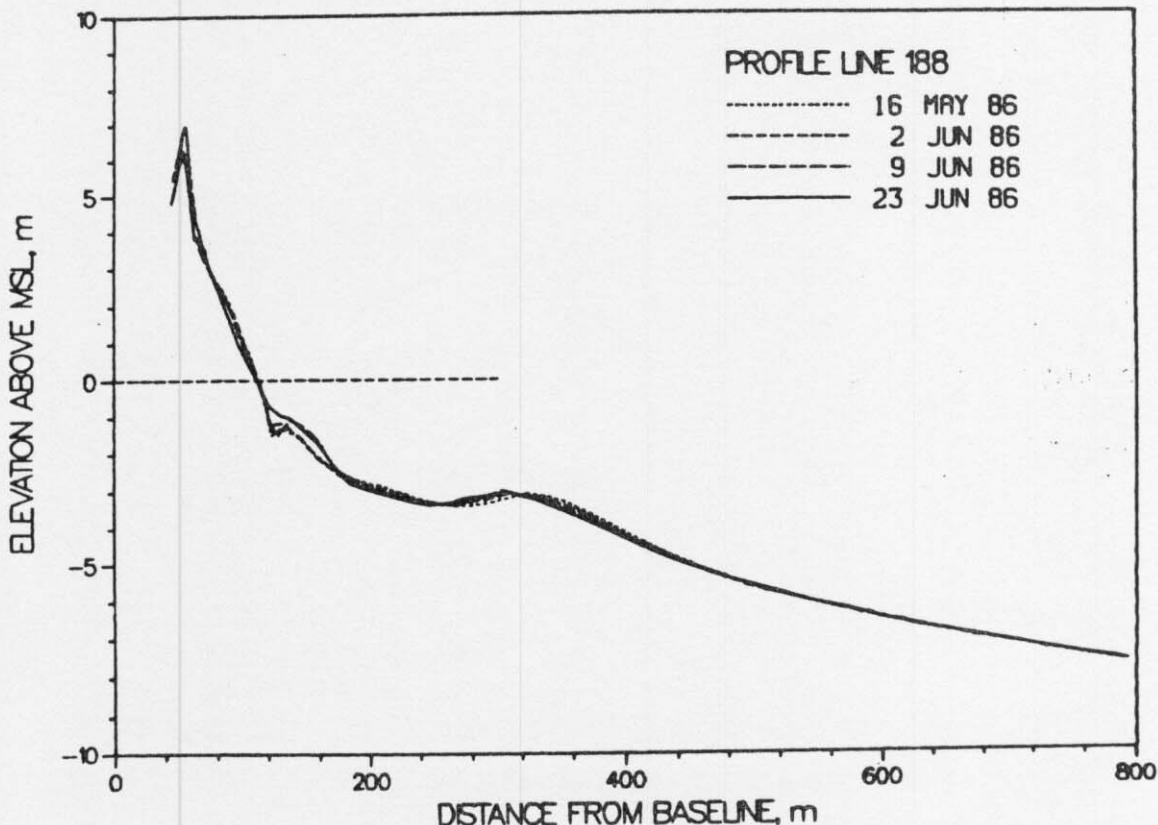


Figure 5. Monthly CRAB profiles on profile 188 - 517 meters south of pier.

The profile envelope (Figure 6) reflects the maximum changes which occurred on the profile between January and June.

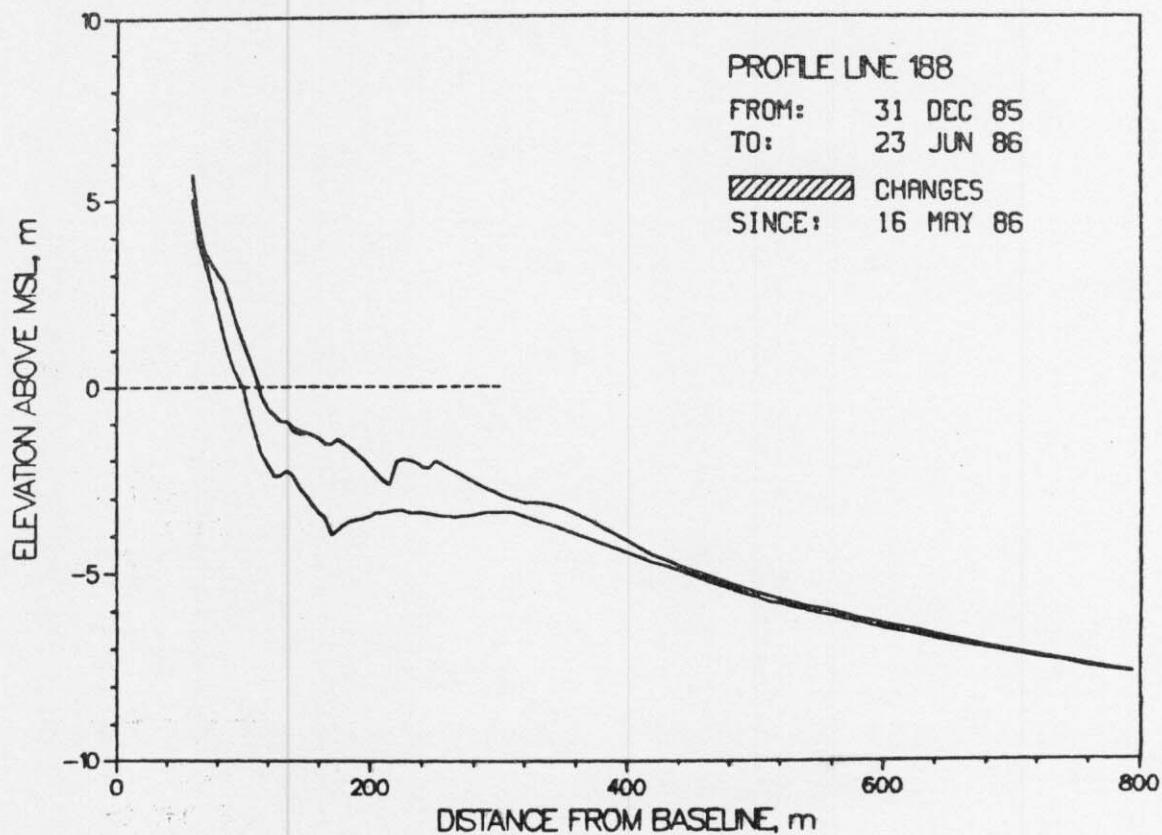


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. This month's bathymetric survey (Figure 7), completed on 11 June, shows a rhythmic variation of the -2 m contour north of the pier, with otherwise typical summer bathymetric contours. The trough under the pier is rather narrow with some elongation of the -3 and -4 m depths to the south, generally an indication that recent waves from the north influenced the bathymetry.

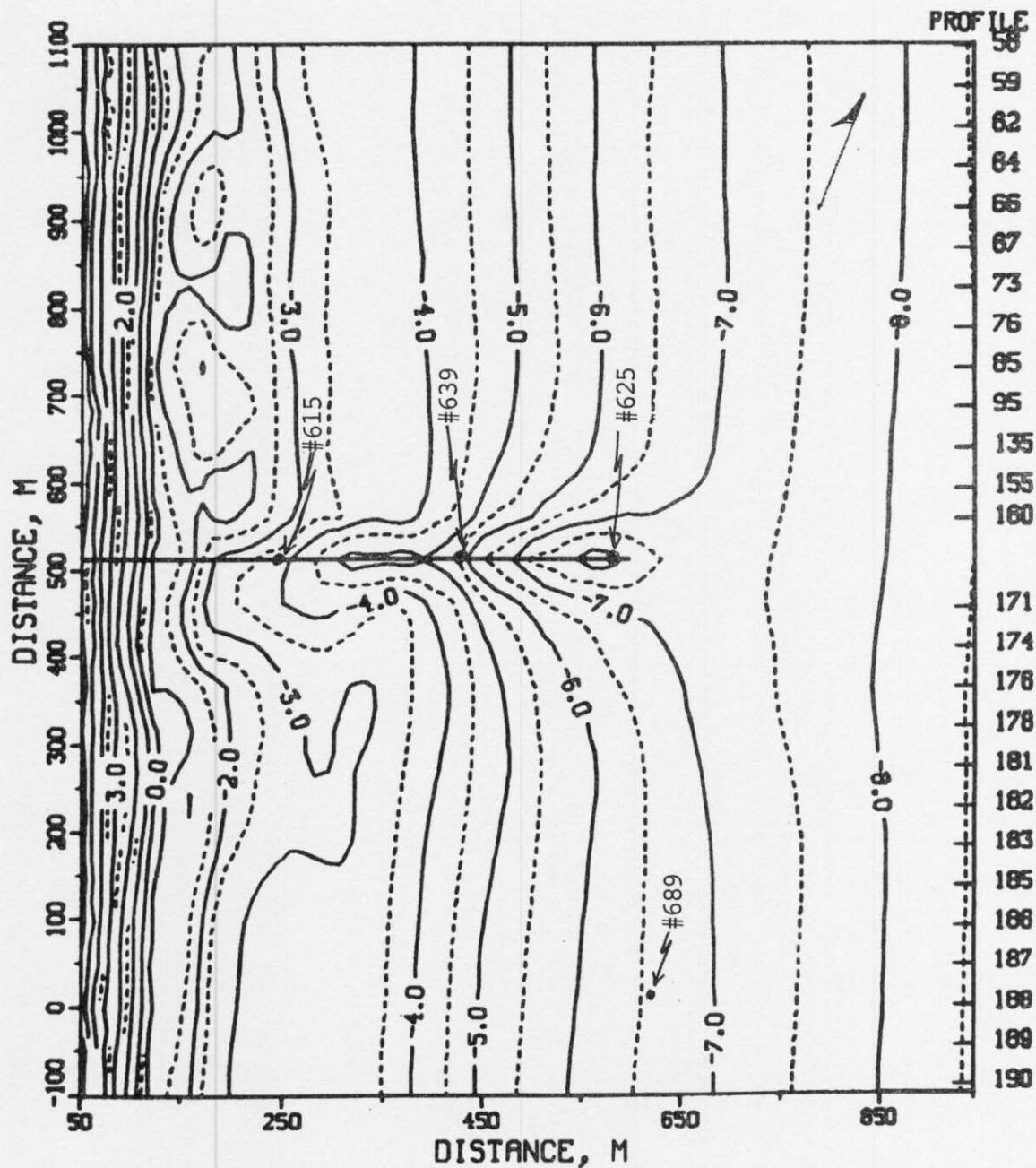


Figure 7. FRF BATHYMETRY 11 JUN 86  
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